BMP induced osteogenesis and continues to express Sostdc1. Thus, one mechanism by which Pax3 maintains the undifferentiated state of neural crest mesenchyme is to block responsiveness to differentiation signals. These studies provide in vivo evidence for the importance of Pax3 down-regulation during the process of differentiation of multipotent neural crest precursors. Hence, inactivation of a developmentally critical transcription factor is an important regulatory step in cranial development.

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Program/Abstract # 110

Late emerging trunk neural crest cells in the turtle *Trachemys scripta* revealed by DiI injection and neural tube organ culture

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Turtle plastron bones develop by intramembranous ossification from the condensation of cells that stain positively for HNK1, PDGFRa and p75, indicating that these bones are derived, like the facial bones, from neural crest cells. At stage 17, well after the initial wave of neural crest migration, cells that are positive for HNK1 and the early neural crest marker, FoxD3 begin accumulating in the thickened dermis of the carapace and migrating to the developing plastron. That these cells are neural crest is controversial; trunk neural crest cells have not been found to generate extensive skeletal elements in extant species, and none of the markers is exclusive for neural crest cells. In the present studies, we turned to the defining attribute of neural crest cells, that of emerging from the neural tube. We injected the lipophilic dye DiI into the lumen of the neural tube of St.17 turtle embryos. Within a day after injection, DiI-positive cells can be seen in the carapacial ridge "staging area" that contains the HNK1-positive cells. Moreover, these cells form migratory streams going away from the dorsum. In addition, we have cultured neural tubes from St.17 embryos, and observed HNK1+ cells migrating away from them. These data support our hypothesis that the plastron bones of the turtle are formed by a late emerging population of neural crest cells that collect dorsally in the carapacial dermis and then migrate ventrally.

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Program/Abstract # 111

Development of the carapacial ridge: Implications for the evolution of genetic networks in turtle shell development

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Paleontologists and neontologists have long looked to development to understand the homologies of the dermal bones that form the "armor" of turtles, crocodiles, armadillos, and other vertebrates. This study shows molecular evidence supporting a dermomyotomal identity for the mesenchyme of the turtle carapacial ridge. The mesenchyme of the carapace primordium expresses Pax3, Twist1, Dermo1, En1, Sim1, and Gremlin at early stages and before overt ossification expresses Pax1. A hypothesis is proposed that this mesenchyme forms dermal bone in the turtle carapace. A comparison of regulatory gene expression in the primordia of the turtle carapace, the vertebrate limb, and the vertebral column implies the exaptation of key genetic networks in the development of the turtle shell. This work establishes a new role for this mesodermal compartment and highlights the importance of changes in genetic regulation in the evolution of morphology.

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